

a Sanscrit authority of the new school; Prof. Weil and Prof. Windisch, both of Heidelberg, the former noted for Arabic learning, the other for Sanscrit and Celtic studies.

The programme of meetings is as follows :—

Sept. 14.—Inaugural Meeting. With Address. 8.30 P.M., at the Royal Institution, 21, Albemarle Street. The meeting will commence with the election of the Council.

Sept. 15.—Semitic Section. President, Sir Henry Rawlinson, K.C.B. Secretary, W. S. Vaux, Esq., F.R.S. Sitting, 2.30 P.M., at the rooms of the Royal Society of Literature, 4, St. Martin's Place, Charing Cross.

Sept. 16.—Turanian Section. President, Sir Walter Elliot, K.C.S.I. Secretary, Prof. Douglas. Sitting, 8.30 P.M., at King's College, Strand.

Sept. 17.—Aryan Section. President, Prof. Max Müller. Secretary, Prof. Eggeling. Sitting, 2.30 P.M., at the Royal Institution, 21, Albemarle Street.

Sept. 17.—Hamitic Section. President, Dr. Birch, LL.D. Secretary, W. R. Cooper, Esq. Sitting, 8.30 P.M., at the rooms of the Society of Biblical Archaeology, 9, Conduit Street.

Sept. 18.—Archæological Section. President, M. Grant Duff, Esq., M.P. Secretary, E. Thomas, Esq., F.R.S. Sitting, 11 A.M., at the rooms of the Royal Asiatic Society, 22, Albemarle Street.

Sept. 19.—Ethnological Section. President, Prof. Owen, C.B. Secretary, R. Cull, Esq., F.S.A. Sitting, 2.30 P.M., at the rooms of the Royal Asiatic Society, 22, Albemarle Street. At the close of the sitting the members of the Congress will decide in what country the next Congress shall be held, and will nominate the president.

There will be receptions on the following occasions :—

Sept. 15.—10 A.M., at the British Museum.

Sept. 16.—11 A.M. The Right Hon. Sir Bartle Frere will give a breakfast to the members of the Congress, at his residence, Wressil Lodge, Wimbledon.

Sept. 17.—10 A.M., at the India Office Library. 12 noon, at the Soane Museum.

Sept. 18.—Mr. Bosanquet will give an afternoon garden party to the members of the Congress, at his residence, Claymoor House, Enfield.

Sept. 19.—10 A.M., at the South Kensington Museum.

During the meeting of the Congress a Bureau will be opened at the Royal Asiatic Society's Rooms, 22, Albemarle Street, W., where every information concerning the Congress may be obtained.

The Committee of the Scientific Club have kindly invited the members of the Congress to make use of their club house, 7, Savile Row, W., during the session of the Congress. The foreign members of the Congress and their friends are invited by the Council of the Royal Botanic Society of London to visit the gardens of the Society, in Regent's Park, at any time during their stay in London. Such members will be admitted to the gardens by producing their cards of membership.

ANDERS JONAS ANGSTRÖM

ANDERS JONAS ANGSTRÖM, Professor of Physics in the University of Upsala, after a short illness of less than a fortnight, died, as we have already announced, on June 20, from an attack of inflammation of the brain. The death of Prof. Angström, who has been cut down in the full vigour of his powers and in the midst of a noble and active scientific career, is a loss to the entire world of science.

Angström was born Aug. 13, 1814, at the Lögdo Iron Works Settlement in Medelpad. He was the son of a pastor, who in the early childhood of Anders Jonas, removed to Ullånger, in Angermanland, and a few years afterwards to Sättna, in the neighbourhood of Sandsväll, where he remained till his death in 1847. With no other means than the extremely limited stipend of a Swedish countryminister,

supplemented by the proceeds of a small glebe, the elder Angström kept his three sons—the present Dr. Johan Angström and Prof. Anders Jonas and his young brother Carl Arendt at school, and even assisted them in their subsequent attendance at the University classes at Upsala. In these efforts the father was strenuously supported by his wife, without whose good management such efforts would have been impracticable; and to advanced age this admirable housewife continued to prosecute her daily task of spinning, without remitting her active supervision of her household.

Although circumstances compelled Angström to eke out the means necessary for his University course by his own exertions, he passed through all his requisite examinations with distinction and within the usual terms. After matriculating in the autumn of 1833, he took the degree of Doctor of Philosophy in 1839; became a physical tutor in the same year, and assistant in practical astronomy in 1843; while in the years 1846 and 1847 he fulfilled the duties of the Chair of Astronomy at the University, during the temporary absence on the continent of the professor. Owing to want of interest he had, however, five years to wait before he obtained any other fixed employment. The Chair of Physics had fallen vacant in 1839, the same year in which Angström graduated; but then, and for some time afterwards, his abilities were not fully recognised in the University, while with his natural modesty he abstained from presenting himself as a candidate, although he might then have enjoyed the same good fortune as his friend and fellow-student, Malmsten, who, after having had four years in which to prepare himself, was able on the death of the Professor of Mathematics, in the year 1843, to offer himself as a successful candidate for the vacant chair. At length, in 1858, on the public recommendation of the Consistory, Angström was nominated to the Chair of Physics, the duties of which he had performed for two years in the character of a *pro tempore* professor. This chair he continued to hold for the remaining sixteen years of his life.

During his occupancy of the chair Angström secured for the physical museum of the University an admirable collection of instruments for the determination of different exact measurements in the various departments of physical science; and as far as the limited resources at his disposal permitted, he improved the physical laboratories, and strove to awaken amongst the students an interest in the study of the exact sciences. He also continued for a number of years, in the capacity of Secretary to the Royal Society at Upsala, to conduct its transactions with a zeal and devotion which secured for him the grateful recognition of foreigners as well as of his own countrymen.

Although Angström published memoirs on almost all branches of physical science, his name will be for ever associated with the history of spectral analysis, for which he obtained from the Royal Society of London in 1870 the Rumford gold medal, a distinction which no Swede had ever before enjoyed.

In order to show Angström's place in scientific history in regard to this class of researches, it will be well in this place to briefly recapitulate the capital points.*

* This recapitulation is based upon the historical statement in Lockyer's "Solar Physics."

Fraunhofer, at the beginning of this century, pointed out the coincidence of place in the spectrum between certain dark lines which he saw in the spectrum of the sun and the bright lines in the spectrum of the flame of a lamp. In Dr. Brewster's note-book, dated St. Andrews, Oct. 28, 1841, this passage occurs:—"I have this evening discovered the remarkable fact that, in the combustion of nitre upon charcoal, there are definite bright rays corresponding to the double lines of A and B, and the group of lines *a* in the space A B. *The coincidence of two yellow rays with the two deficient ones at D, with the existence of definite bright rays in the nitre flame, not only at D but at A, a and B, is so extraordinary that it indicates some regular connection between the two classes of phenomena.*"

We next have an important experiment made by Foucault in 1849, who pointed out that the electric arc presented us with a medium which emits the rays D on its own account, and which at the same time absorbs them when they come from another quarter.

The received explanation of this coincidence between the two bright lines of burning sodium vapour, and the two dark lines D in the solar spectrum, which extended the grasp of spectrum analysis from terrestrial substances to the skies, was taught by Prof. Stokes in his lectures about 1852, but was not published.

In 1853 the idea was first published by Angström.*

In his memoir, for the purpose of illustrating the absorption of light, he made use of a principle already propounded by Euler, in his *Theoria lucis et caloris*, that the particles of a body, in consequence of resonance, absorb principally those ethereal undulatory motions which have previously been impressed upon them. He also endeavoured to show that *a body in a state of glowing heat emits just the same kinds of light and heat which it absorbs under the same circumstances.* He further undertook researches on the electric light, and stated that in many cases the Fraunhofer lines were an inversion of the bright lines, which he observed in the spectrum of various metals.

Early in 1859, Mr. Balfour Stewart independently discovered the law which binds together radiation and absorption, establishing it experimentally as an extension of Prévost's law of exchanges in the case of the heat rays, and generalising his conclusion for all rays.

In October of the same year, 1859, Kirchhoff established experimentally the same law for the light rays.

On the occasion of Angström's admission to the membership of the Royal Society, General Sabine in his introductory address mentioned that the obstacles opposed by the language in which Angström's treatise had been written, and by distance from the scene of his investigations, had for three years prevented its very existence from being known to the scientific world at large; but when once the nature of that treatise became known, the fact was immediately acknowledged, that in Professors Stokes and Angström we are bound to recognise the fathers of spectral analysis. Indeed, in the "*Optiska Undersökningar*" of the latter are to be found many of the fundamental principles of much that has since been accomplished in that department of scientific inquiry. In his work entitled "*Recherches sur le spectre solaire*," with its atlas of the normal spectrum of the sun, Angström has given us an

* "*Optiska Undersökningar*:" Trans. Royal Academy of Stockholm, 1853. Translated in Phil. Mag. 4th series, vol. ix. p. 237.

indispensable adjunct for all future students of spectrum analytical investigations.

We have already stated that Angström published memoirs on subjects connected with nearly every department of physical inquiry. Thus we have papers:—(1) "*Sur la polarisation rectiligne et la double réfraction des cristaux à trois axes obliques*" (Upsala Vetenskaps-Societets Acta), in which he gives the solution of the problem involved in the optical phenomena presented by such crystals which had been sought, but without success, by Neumann and MacCulloch. (2) On the "*Monoklinoedrisk kristallernas molekylära Constanter*" (Vet. Akad.'s Handlingar, 1859). (3) "*Ny metod at bestämma kroppars ledningsförmåga för Värme*"—New method of determining the capacity for conducting heat in the human body—(Vet. Akad. Förh. 1861); which contains the first determinations ever given of the absolute values of the capacity for conducting heat. (4) "*Sur deux inégalités d'une grandeur remarquable dans les apparitions de la Comète de Halley*" (Upsala Vet. Soc. Acta.). This treatise first excited the expectation amongst astronomers of obtaining certain results by means of a single method. (5) "*Sur les Spectres des gas simples*" (*Comptes Rendus*, 1871).

These are among the most important of Angström's numerous treatises, and in addition we may instance his celebrated monograph, "*Mémoire sur la température de la terre*" (Upsala Vet. Soc.'s Acta.), as well as a paper belonging to an earlier period, which appeared in the "*Denkschriften der Münchener Academie*," 1844, under the title of "*Magnetische Beobachtungen bei Gelegenheit einer Reise nach Deutschland und Frankreich*."

As might naturally be expected, numerous scientific Societies sought the honour of numbering Angström amongst their members, as for instance:—Kungl. Vet. Akad. i. Stockholm; Kungl. Vet. Akad. i. Upsala; the Royal Societies of Berlin, Copenhagen, London, &c. He was, moreover, appointed Corresponding Member of the French Institute; he twice obtained the Walimarsk prize of the Vet. Akad. of Stockholm in 1865, in conjunction with Professors Thalén and H. Holmgren, and in 1869 with the former alone. He carried off two other prizes given by the same Society, and once he obtained a grant of money for his observations from the University of Upsala, before he had become a member of the Upsala Vet. Soc., which was the more acceptable to him, since for a long period he reaped a very inadequate pecuniary return for his scientific labours. Partly by the aid of the State, but mostly at his own personal expense, Angström several times visited the Continent, especially France and Germany. He was absent from Sweden in the years 1843, 1844, 1859, and during the summers of 1866 and 1867; but with one exception he attended all the meetings of the Scandinavian Association for Natural and Physical History. In recognition of his great merits, Angström was made Knight of the "Order of the North," and Commander of the Vasa Order 1st Class, and of the "Crown of Italy."

THE IRON AND STEEL INSTITUTE

THIS prosperous and useful association held its sixth summer meeting last week, from the 1st to the 4th instant, at Barrow-in-Furness, a town whose rapidity of growth is unparalleled out of America. Twenty-five years